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N82-15722

Hematological and Immunological Analyses

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Hematological and immunological analyses were conducted on the primary and backup crewmembers of STS-1 so that body-function values necessary for the objective assessment of the health status of the crew before launch and immediately after flight could be evaluated by the medical staff. Blood samples were collected by venipuncture from the two prime and two backup crewmembers 30, 10, and 2 days before flight (F-30, F-10, F-2 respectively). Additionally, blood samples were collected from the two prime crewmembers directly after landing and again 3 days later (L+0, L+3, respectively). Further specifications are given in "Clinical Laboratory Support Plan for Orbital Flight Test (OFT) Missions, JSC-14374."

To obtain useful data, the following constraints were observed.

- A 14-hour fasting preceded all blood withdrawals with the exception of the immediate postflight (L+0) which was collected before any postflight intake of food or drink (except water).
- Alcoholic beverages were not consumed for a minimum of 14 hours preceding blood sampling.
- Blood sampling occurred as the first scheduled activity during the examination period and was performed as early in the morning as possible. The L+0 sample was not collected upon arising and therefore is not strictly analogous with the other samples.

Cellular immunology analyses were conducted on blood collected with sodium heparin whereas ethylene diamine tetra-acetic acid (EDTA) was the anti-coagulant of choice for the cellular hematology measurements (Figure 12-1). Humoral evaluations were conducted on serum from standard clot tubes. In all cases, vacutainer (TM) tubes were used for blood collection.

Results and Discussion

The analyses conducted on the cellular blood components of the primary and backup crewmembers indicated that for the one-month period preceding the flight, there were no unusual variations in the cellular blood components of the crewmembers. However, there were alterations in both of the primary crewmembers after the flight.

The day of landing, both crewmembers exhibited an apparent increase in the erythrocyte count. This was accompanied by a slight decrease in the mean corpuscular volume (MCV), an increase in the hematocrit, and an unchanged reticulocytes production index. Our previous spaceflight experience would indicate that there are at least two factors working simultaneously. The previously reported fluid shift is reflected in the elevated hematocrit which would indicate a loss of fluid from the peripheral blood. This, of course, would cancel out the apparent increase in erythrocytes so that the absolute number would remain the same. Secondly, the previously reported red cell mass loss would be reflected in the decreased MCV, indicating that (in this case at least) the loss is due to a decrease in the size of erythrocytes rather than a decrease in the number. It is suggestive that even this volume loss could be attributed to a fluid imbalance as the mean corpuscular hemoglobin remained the same.

The above interpretation is largely supported by careful analysis of the apparent leukocytosis exhibited by both the crewmembers after the flight. The data are suggestive that, due to the fluid loss, there was actually no change in the absolute neutrophil count (which was responsible for the apparent leukocytosis), and that there was an absolute decrease in the number of lymphocytes. This phenomenon is of importance in

evaluating the cellular immunology data which are discussed later.

Analyses were also conducted on the humoral blood components of the primary and backup crewmembers. As with the cellular components, the derived values demonstrate that for the one-month period preceding the flight, there were no unusual variations among any of the four crewmembers. The major postflight activity of interest was the slight increase in total serum proteins of both prime crewmembers. This would not be unexpected accompanying a loss of fluid. Additionally, there were sporatic changes in the postflight concentration of IgA, ceruloplasmin, and complement factor 4. The significance of these occasional alterations cannot be explained at this time.

Cell-Immunological Activity: Lymphocytes extracted from crew blood samples were reacted with the mitogen phytohemagglutinin (PHA) to assess the competence of the in vitro immune response. After a suitable incubation period, the blastogenic response was measured by determining the incorporation of radioactive thymidine into newly formed DNA. These data show that there was a significant ($p < 0.01$) decrease in the ability of lymphocytes to respond to mitogenic assault postflight. Further, these data show that the deviation is only minimally recovered by 3 days after landing. It is not clear at this point whether this phenomenon was due to the relative lymphopenia discussed above or a decrease in the activity potential of individual cells.

Concluding Remarks

Alterations in the peripheral blood components were noted that can be variously explained. The explanation most consistent with previously reported findings is that there was a phase imbalance which resulted in a relative decrease in fluid volume. Concomitant with this fluid imbalance there is also evidence to support an absolute decrease in mean erythrocyte volume, a peripherial lymphopenia, and a marked decrease in blastogenic response of lymphocytes to in vitro mitogenic challenge.

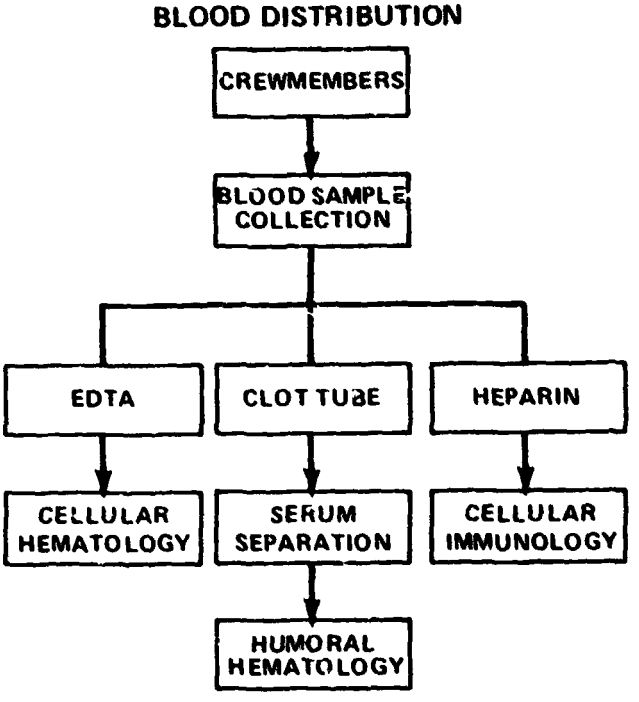

Figure 12-1